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Revision of the New World Genus *Lotisma* (Lepidoptera: Copromorphidae)[1]

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Abstract.—*Lotisma* Busck is revised for the two included species: *L. trigonana* (Walsingham), from western North America and *L. vulcanicola* Meyrick, from Costa Rica. A new subspecies, *L. trigonana durangoensis,* is described for a disjunct population from Durango, Mexico. The larva of *L. trigonana* is described and illustrated, showing relationships closest to *Ellabella* Busck.

The genus *Lotisma* is a small western North American genus encompassing one very widespread species, *Lotisma trigonana* (Walsingham), and one species from Costa Rica, *Lotisma vulcanicola* Meyrick. The genus has had a history of varying family placement. Walsingham (1879) described the first species in Tortricidae, inasmuch as they resemble some species of *Decodes.* Busck (1909, 1925) and Meyrick (1932) placed the genus in Glyphipterigidae and Yponomeutidae. More recently, following a study of world genera of Glyphipterigidae, this amorphous family was segregated into several families, with a number of odd genera being transferred to other families, among these *Lotisma* (Heppner, 1978) to Copromorphidae. *Lotisma* clearly is not a glyphipterigid, but head morphology, wing venation, genitalia characters, and characters of the immature stages point to a placement in Copromorphidae. MacKay (1972) was the first recent scientist to note that the genus had some relationship to Carposinidae, a family related to Copromorphidae, by comparison of larval characters.

Lotisma is here characterized morphologically in detail, along with the adults and immature stages of *L. trigonana,* plus redescription of *L. vulcanicola. Lotisma trigonana* is known from Alaska to Costa Rica, but the disjunct nature of the Mexican and Costa Rican populations has prompted the naming of this segregate as a separate subspecies.

Lotisma Busck

Lotisma Busck, 1925:98 (Type-species: *Sciaphila trigonana* Walsingham, 1879, orig. design).

Adult.—Small moths, 6.5–11.0 mm forewing lengths. *Head* (Figs. 1, 3): vertex somewhat roughened; frons similar; labial palpus slightly upcurved, with long median segment (2× basal or apical segments); maxillary palpus (Figs. 2, 4) relatively large, 3-segmented; haustellum well-developed, long, unscaled; pilifer

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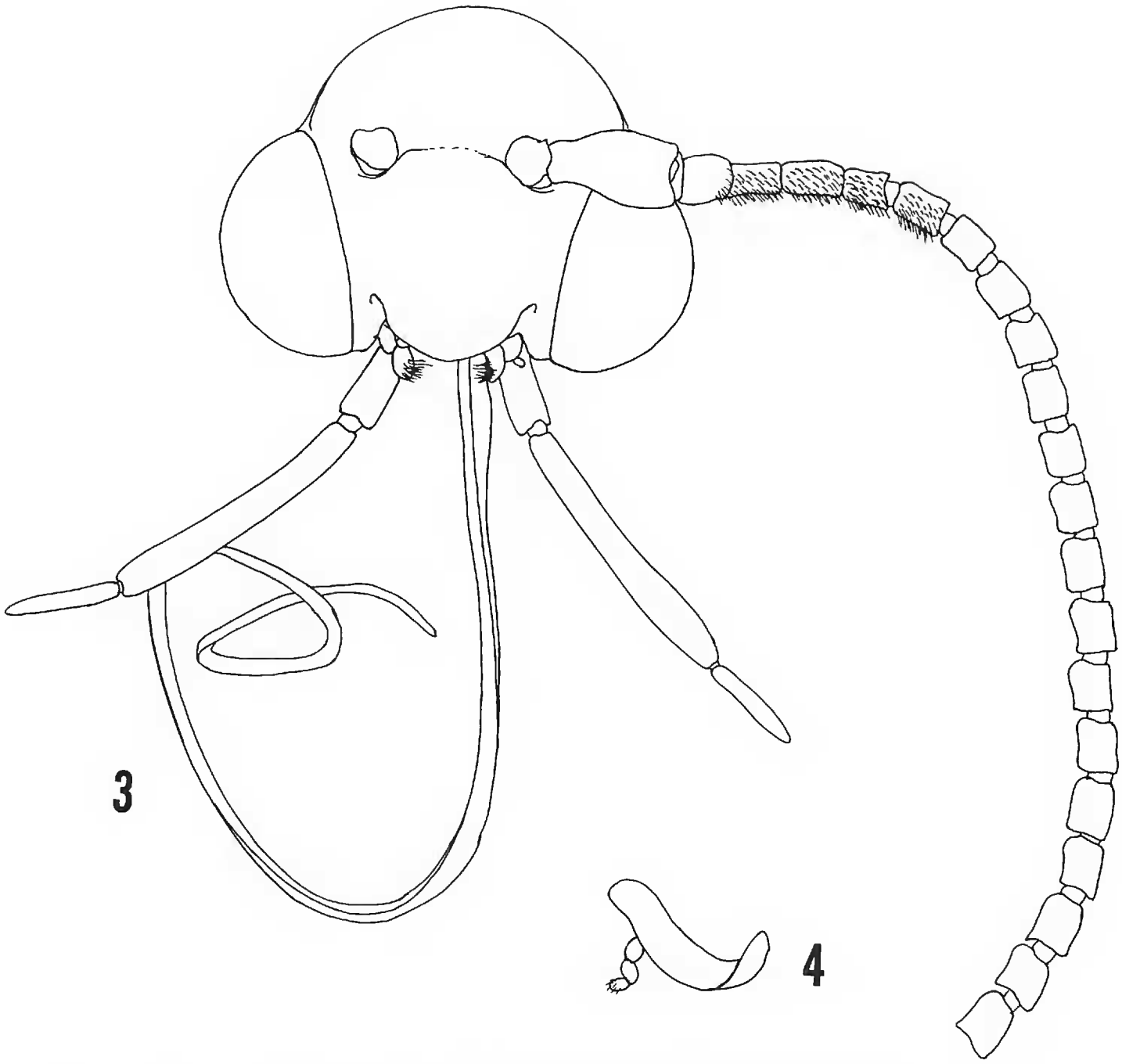
Figures 1, 2. Head morphology of *Lotisma trigonana* (Walsingham). 1. Head profile (USNM 77335, California). 2. Same, detail of haustellum base, maxillary palpus, and pilifer.

large; compound eye large (⅔ of head height); ocellus absent; antenna (Fig. 3) filiform, with ventral setae, and normal length (½ forewing length), not noticeably sexually dimorphic; antennal scape without pecten. *Thorax:* normal; legs 0-2-4 spur formula, with small foreleg epiphysis. *Forewing* (Fig. 5): subelongate (ca. 3× long as wide); apex slightly pointed, termen somewhat oblique to rounded tornus; all veins present and separate; R_5 to termen near apex; chorda absent; cell closed, with slight vestigial median vein evident; M_1–M_3 nearly equidistant, with M_3 very near to CuA_1; cubital veins curved near end of cell, becoming parallel toward termen; CuP present near tornus; A_{1+2} with basal fork; A_3 very small. *Hindwing* (Fig. 5): subovate-elongate (ca. 2× long as wide); apex distinct but rounded; termen a broad oblique curve to rounded tornus; all veins present; Rs separate from Sc; median veins with M_1 close to M_2 at base and M_3 stalked with CuA_1; cell with vestigial median vein evident; CuA_2 becoming parallel to CuA_1 at termen; CuP evident along most of wing to tornus; A_{1+2} with small basal fork; A_3 long; A_4 small. *Abdomen:* normal; ♂ with pair of external coremata on sternite 7. *Male genitalia:* uncus a well-developed, narrow projection; gnathos undeveloped; socius absent (but many setae on uncus); transtilla absent; valva elongate, setaceous, with an overlapping sacculus with separate appendages; anellus a U-shaped plate; tegumen rounded; vinculum small, half-hexagonal; saccus absent; aedeagus short, with phallobase and single rugose cornutus. *Female genitalia:* ovipositor short (1.5× length of segment 7), setaceous papilla analis; apophyses average, with posterior pair twice length of anterior pair; ostium a simple funnel (sclerotized) on intersegmental membrane between sternites 7 and 8; ductus bursae membranous after sclerotized area, merging into ostium, subequal in length to bursa length or short; corpus bursae a simple oval or with elongate extension; ductus seminalis emergent from sclerotized part of ductus bursae; signum absent.

Immature stages.—Larvae bisetose (prothoracic L-group); crochets uniordinal mesal penellipse (or incomplete circles); D1 absent on A9. Pupae unspined.



Figures 3, 4. Head morphology of *Lotisma trigonana* (Walsingham). 3. Head frontal view (USNM slide 77711), Washington. 4. Same, detail of maxillary palpus and haustellum.

Hosts.—Borers of Ericaceae fruits.

Distribution.—Southern Alaska to southern California, along the Pacific Coast; disjunct records in Durango, Mexico, and Costa Rica.

Species.—Two known species.

Remarks.—*Lotisma* appears nearest to *Ellabella* Busck, although each genus is relatively isolated in Copromorphidae (Heppner, 1984). Characters of the adult head and wing venation, together with the morphology of the immature stages, support this conclusion. The larval and pupal similarities have been pointed out by DeBenedictis (1984), in that most of the larval chaetotaxy is the same for both genera, likewise for the pupae. Head characters vary more in the two genera, since *Lotisma* lacks ocelli and has only 3 maxillary palpi segments evident, but pilifers are equally large as in *Ellabella,* as is the relative length of the 2nd labial palpus segment; antennal setae are also similar. Wing venation is similar in each genus, with *Lotisma* having M3 more distant from M2 in the forewing and M1 more

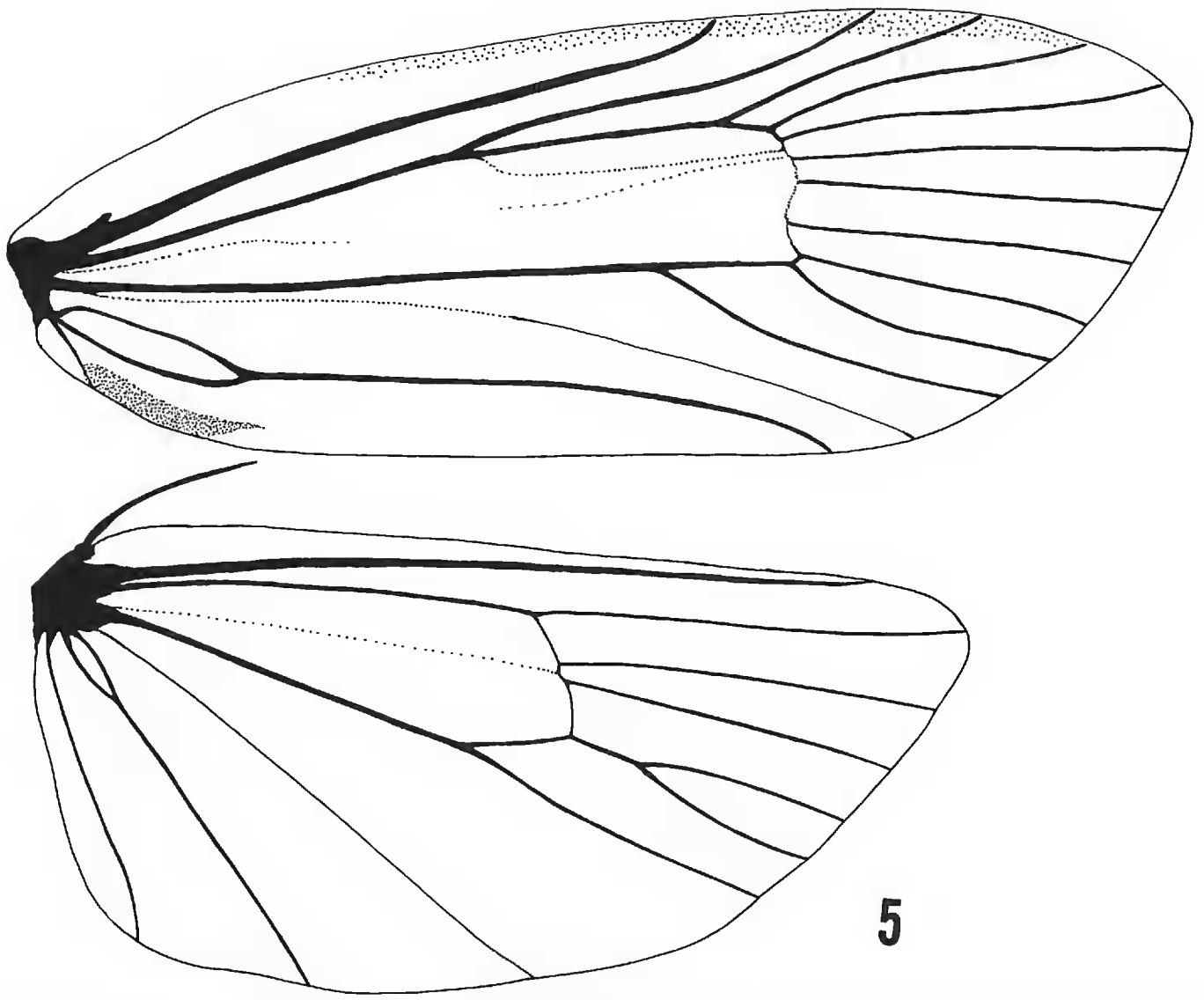


Figure 5. Wing venation of *Lotisma trigonana* (Walsingham), British Columbia (USNM 77070).

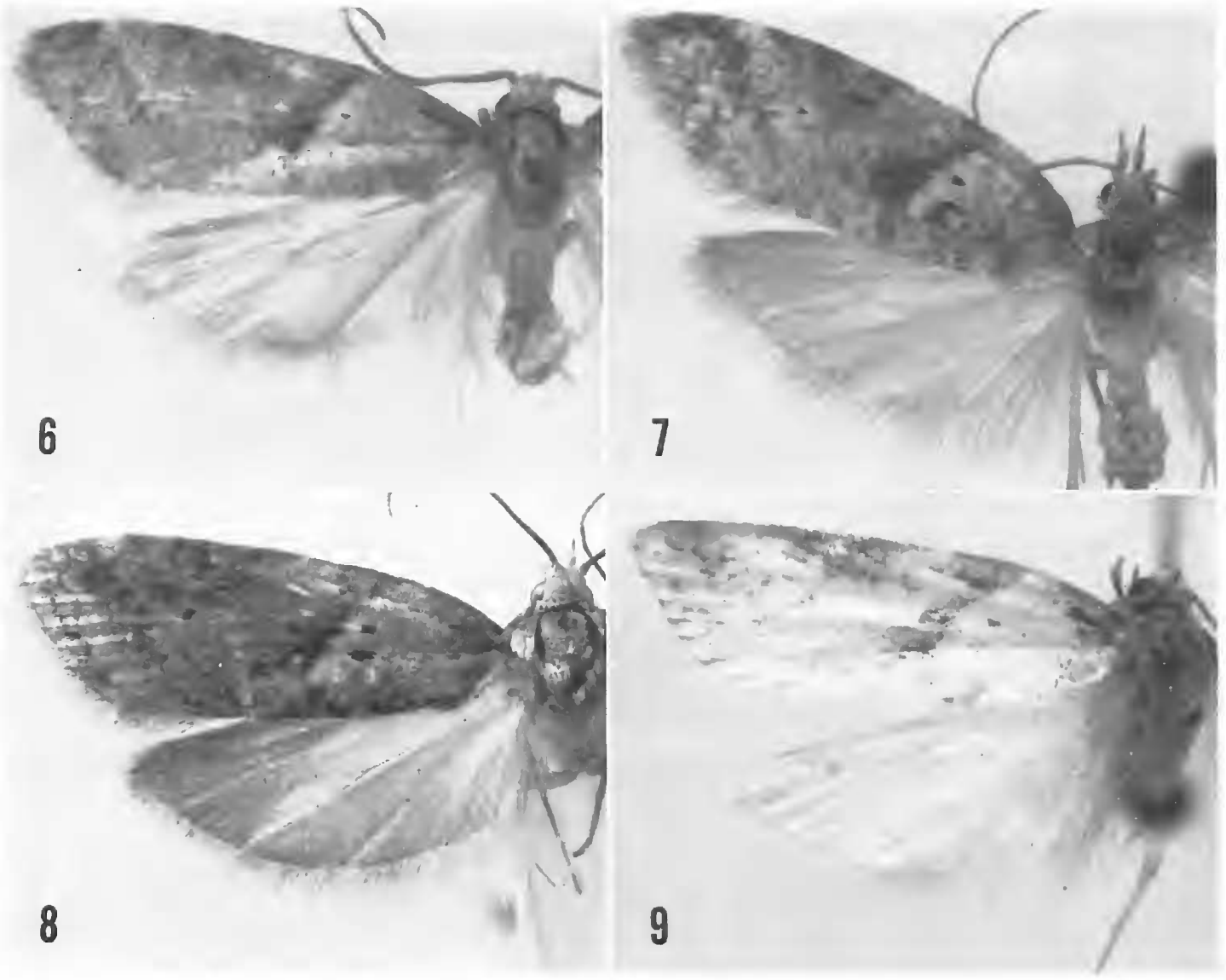
approximate to M2 in the hindwing than in *Ellabella,* and with the hindwing M3 connate with CuA_1 near the cell end; the pterostigma seems absent in *Ellabella. Lotisma* lacks the anterior and posterior corematal hairs of the abdomen of *Ellabella.*

Lotisma trigonana (Walsingham)

Sciaphila trigonana Walsingham, 1879:22.
Hemerophila kincaidiella Busck, 1904:747.
Lotisma trigonana.—Busck, 1909:98.

This species is here divided into two subspecies, the nominate subspecies occurring from south Alaska to southern California and the new subspecies occurring in western Mexico.

Male.—Head: gray with white on frons and laterally from vertex; antenna gray with white on anterior side of scape; labial palpus brown and gray with apical segment white and white on mesal side of palpus. *Thorax:* gray with white on posterior ends of patagia; venter white; legs dark gray and brown, with white bands on distal ends of each segment. *Forewing* (Fig. 6): white mixed with gray near anal and costal margins, with dark brown at base near costa and as a large median triangular patch having a sharp diagonal border from costa diagonally directed toward mid-wing; usually more diffuse border distally; large dark patch with white midway on costal margin, two small dark brown spots, one at ⅓ from



Figures 6–9. Adults of *Lotisma.* 6. *L. trigonana trigonana* (Walsingham), ♂ California (UCB). 7. ♀, California (CAS). 8. *L. t. durangoensis,* n. subsp., ♀ holotype (UCB), Durango, Mexico. 9. *L. vulcanicola* Meyrick, ♂ holotype (NHMV), Costa Rica.

base (sometimes two small spots at this point) and one at ⅔ from wing base; apical quarter with two more or less distinct subterminal dark brown lines, with the more distant from termen being more broken into irregular spots; apical border dark brown; fringe gray; venter gray-brown. *Hindwing:* uniform pale gray-brown, becoming more white centrally; fringe gray and white; venter pale gray and white. *Abdomen:* gray-brown or tan and white.

Female.—Similar to male (Fig. 7).

Immature stages.—*Larva* white, head capsule amber; pinacula distinct but little sclerotized (not amber). Head (Figs. 22, 23) hypognathous; frontoclypeus ⅔ distance to epicranial notch; stemmata in oval, 6 in number; labrum as illustrated (Figs. 21, 23); submentum as illustrated (Fig. 24), with posterior sclerotized arms bifurcate and with tuberculate central setae; mandible with 5 teeth (Fig. 25). Prothorax with sclerotized dorsal shield; L-group bisetose on single pinaculum; D1 close to D2; SD1 distant from SD2; SV setae approximate on single pinaculum. Meso- and metathorax with D1 approximate to D2 and SD1 approximate to SD2, each group on a single pinaculum; L1 approximate to L2 on one pinaculum but together distant from L3. Abdominal segments with prolegs on A3–6; crochets uniordinal in mesal penellipse (or incomplete circle); setae D1 closer together dorsally than D2 on A1–8; SD2 minute; L1 approximate to L2 on single pinac-

ulum, distant from L3; SV group trisetose except on A8 and A9; segment A9 with D1 absent; segment A10 with 6 terminal setae and 2 dorsal setae.

Pupa unspined but with simple setae on abdominal tergites.

Hosts.—The following host data is available from specimen labels or literature references:

Arbutus menziesii Pursh (Ericaceae) (Berkeley Hills, California; British Columbia).
Arctostaphylos sp. (Ericaceae) (Marin County, California).
Gaultheria shallon Pursh (Ericaceae) (Steelhead, British Columbia).
Oxycoccus sp. (Ericaceae) (Sea View, Oregon).
Vaccinium sp. (Ericaceae) (Olympia, Washington; Baudon, Oregon).
Vaccinium sp. (Ericaceae) (Sierra Morena, San Mateo Co.).
Vacinium ovatum Pursh (Ericaceae) (Jig Harbor & Rosedale, Washington (James, 1955)).

Distribution.—Alaska to southern California, along the Pacific Coast; disjunct populations near Durango, Mexico, and Costa Rica.

Lotisma trigonana trigonana (Walsingham)

The nominate subspecies occurs along the Pacific Coast, Alaska to southern California.

Forewing length.—6.5–11.0 mm (♂); 6.5–10.8 mm (♀).

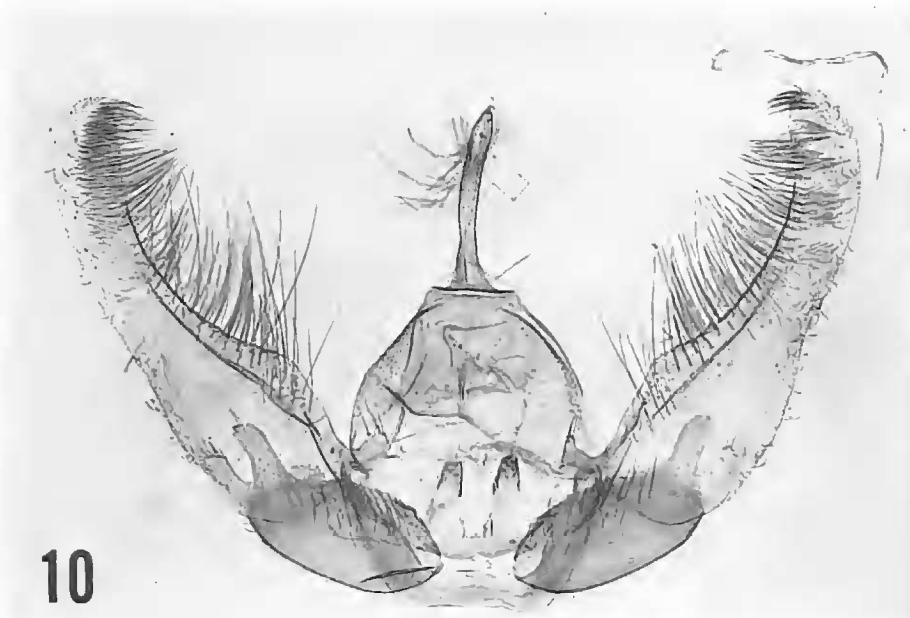
Male (Fig. 6).—As described for the species. *Male genitalia* (Fig. 10): as described for the genus but with the following particulars: uncus long (ca. 2× anellus height); valva evenly narrow to apex after basal width; anellus with basal invagination; aedeagus (Fig. 11) with apical spines.

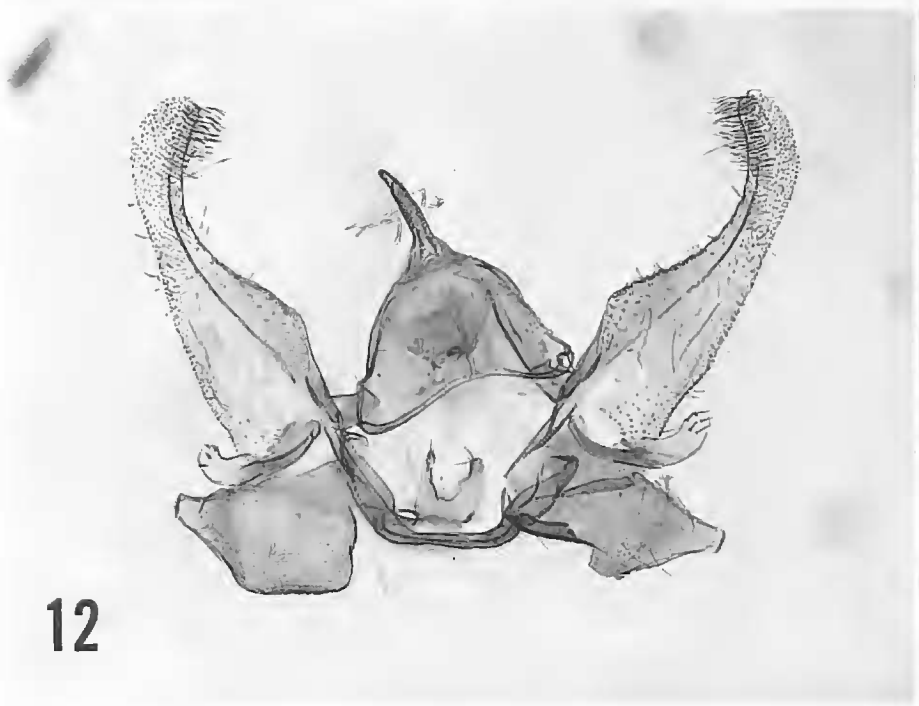
Female (Fig. 7).—Not significantly different in coloration from the male. *Female genitalia* (Figs. 14, 15): as described for the genus but with the following particulars: papilla anales subequal to anterior apophyses; ductus bursae sclerotized area about 2× length of ostial funnel (Fig. 16), overall length subequal to bursa; corpus bursae ovate without extension.

Flight period.—Feb.–Apr., June (Alaska); May–early Sept. and Oct.–Dec. (Wash.–B.C.); Jan.–Dec. (Calif.).

Types.—Lectotype ♂ (BMNH) (*Sciaphila trigonana* Walsingham): nr. Mendocino City (Mendocino Co.), Calif. 3-5-1871, Walsingham (desig. by Heppner, 1982:279); 1 ♂, 4 ♀ paralectotypes, (same data) (BMNH). Lectotype ♂ (USNM) (*Hemerophila kincaidiella* Busck): Seattle [King Co.], Washington, [no date], Kincaid (hereby designated); 2 ♂ paralectotypes, (same data), 1-III-1896, "Type No. 7809" (USNM); 1 ♂ paralectotype, (same data), 16-VI-1901 (LACM). [Lectotypes are chosen from the best specimen among the syntypes.]

Additional specimens.—(243 ♂, 163 ♀): CANADA. British Columbia.—Fitzgerald, 17-IV-1922 (2 ♂), W. R. Carter (USNM). Fraser Mills, 10-IV-1921 (3 ♂), 24-VII-1921 (1 ♀), [no date] (1 ♂), L. E. Marmont (USNM). Goldstream, 18-IV-1921 (3 ♀), E. H. Blackmore (USNM). Maple Bay, Vancouver Id., 13-VII-1933 (3 ♀), J. H. McDunnough (CNC). New Westminister, 5-VII-1900 (2 ♀), 6-VII-1900 (1 ♂, 1 ♀), 11-VII-1900 (1 ♂), 15-VII-1900 (1 ♂), 22-VII-1900 (2 ♀), C. Durrant (BMNH). Saanich Dist., 1-III-1922 (5 ♂), W. Downes (CNC); 4-XII-1953 (4 ♂, 1 ♀—CNC; 2 ♂, 1 ♀—USNM), O. Peck, "*Arbutus menziesii* berries." Steelhead, VIII-1933 (2 ♂, 1 ♀), H. B. Leech, em. 21-XI-1933 "berries of *Gaultheria shallon*"





Figures 10–13. Male genitalia of *Lotisma*. 10. *L. trigonana trigonana* (Walsingham), ♂, California (JBH 290, CAS). 11. Same, detail of aedeagus [enlarged]. 12. *L. vulcanicola* Meyrick, ♂ holotype (NHMV), Costa Rica (JBH 912) [sacculus pushed down]. 13. Same, detail of aedeagus [enlarged].

(CNC). Uctuetet, 11-VII-1909 (2 ♂, 1 ♀), (CNC). Vancouver, 4-III-1905 (1 ♂), 4-III-1906 (1 ♂), 13-III-1905 (1 ♀), 24-III-1906 (1 ♂), 29-III-1903 (1 ♂), 5-IV-1903 (1 ♂), W. Downes (CNC). Victoria, 18-VII-1921 (1 ♀), (USNM); 23-II-1921 (4 ♂), 24-II-1921 (8 ♂), 10-X-1922 (1 ♂), W. Downes (CNC). Wellington, 25-III-1899 (1 ♀), [W. G. Dietz] (MCZ); 1-IV-1904 (2 ♂), 3-IV-1904 (2 ♂), (INHS); 7-IV-1902 (1 ♀), (USNM); 8-IV-1903 (1 ♀), G.W. Taylor (USNM); 10-IV-1902 (1 ♀), (ANSP); 14-IV-1902 (1 ♀), (ANSP); 14-IV-1903 (1 ♂), (INHS); 16-IV-1903 (1 ♂), 18-IV-1902 (1 ♂), 20-IV-1903 (1 ♂), (USNM); IV-[1903] (3 ♂, 3 ♀—ANSP; 2 ♂—LACM; 4 ♂, 2 ♀—USNM), G. W. Taylor; VI-1902 (1 ♂), W. G. Dietz (MCZ); 10-XI-1956 (1 ♂), R. Guppy (CPK).

UNITED STATES. Alaska.—Orca, 27-VI-1899 (1 ♀), T. Kincaid, "Harriman Expedition '99" (USNM).

California.—*Alameda Co.:* Berkeley, 23-I-1965 (1 ♀), 24-I-1966 (1 ♂), 4-II-1966 (1 ♀), 20-II-1966 (1 ♂), 11-III-1963 (1 ♂), 10-V-1965 (1 ♀), 23-V-1965 (1 ♂), 19-IX-1965 (1 ♂), R. L. Langston (UCB); 22-V-1960 (1 ♀), V. Bert (UCB); 14-XII-

Figures 14–16. Female genitalia of *Lotisma*. 14. *L. trigonana* (Walsingham), ♀ lectotype (BMNH slide 20212), California. 15. *L. trigonana* (Walsingham), ♀ (CAS), California (JBH 911). 16. Same, detail of ostium.

1960 (1 ♀), J. A. Powell (UCB). Moraga Ridge, 11-VI-1926 (1 ♂), H. H. Keifer (CAS). Strawberry Cyn., Berkeley, 15-I-1963 (1 ♀), J. A. Powell (UCB). *Contra Costa Co.:* Berkeley Hills, 14-IV-1966 (1 ♀), r. f. *Arbutus menziesii* (9-V-1966), J. A. Powell (UCB). El Cerrito, 19-VI-1960 (1 ♂), C. D. MacNeill (CAS); 23-X-

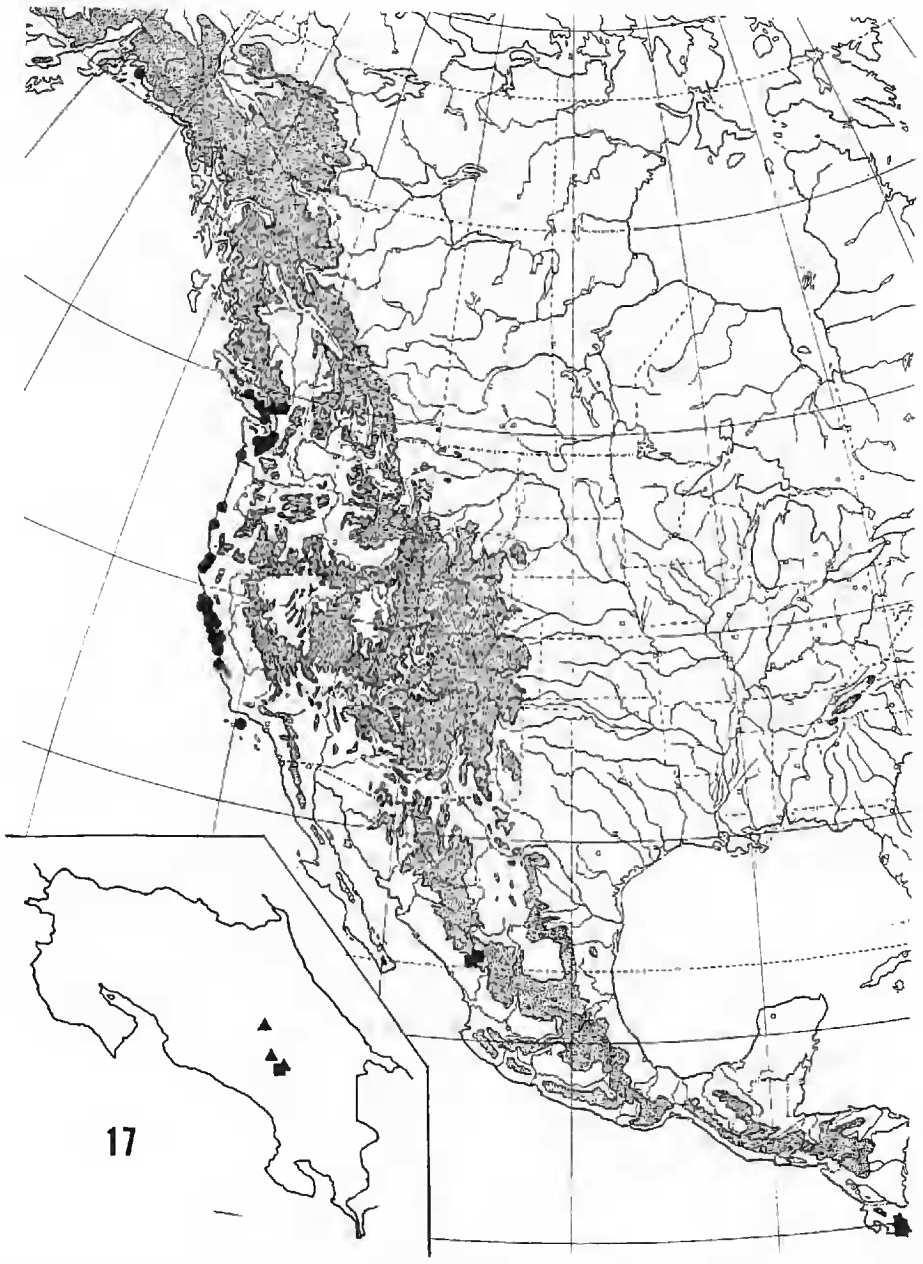


Figure 17. Distribution map of *Lotisma* (with inset of Costa Rica): *L. t. trigonana* (Walsingham) (●); *L. t. durangoensis,* n. subsp. (■); *L. vulcanicola* Meyrick (▲). [1500 m elev. shaded]

1960 (1 ♀), T. R. Haig (CAS). Orinda Village, 25-V-1970 (1 ♀), E. I. Schlinger (UCB). Richmond, 9-IV-1966 (1 ♀), J. Slater (UCB); 23-V-1959 (1 ♀), 28-V-1959 (♀), C. D. MacNeill (CAS). *Humboldt Co.:* Arcata, 15-VII-1969 (2 ♂), 16-VII-1969 (1 ♂), J. A. Powell (UCB). Briceland (5 mi NW), 2–3-IX-1973 (1 ♀), J. A. Powell (UCB). Myers Flat, 23-VIII-1960 (1 ♂, 1 ♀), J. A. Powell (UCB); nr. Myers Flat, 31-VIII-1960 (1 ♂), 2-IX-1960 (1 ♂), C. D. MacNeill (CAS). *Los Angeles Co.:* Chinese Harbor (ridge), Santa Cruz Id., 9-VI-1966 (1 ♀), J. A. Powell (UCB). *Marin Co.:* Inverness, I-10-1964) (2 ♂, 1 ♀), P. H. Arnaud (CAS); 3-II-1963 (1 ♂), 6-VII-1963 (3 ♂, 1 ♀), 7-VII-1963 (1 ♂), 20-VII-1962 (1 ♂), 8-VIII-1962 (1 ♂, 1 ♀), 19-VIII-1962 (1 ♂), 2-IX-1962 (1 ♀), 8-IX-1962 (4 ♂), C. A. Toschi (UCB). Inverness Ridge, 15-V-1970 (2 ♂), J. A. Powell (UCB). Mill Valley, 17-I-1926 (1 ♀), 4-II-1926 (1 ♂, 3 ♀), E. P. Van Duzee (CAS); 11-II-1910 (1 ♀), F. X. Williams (CAS); 11-II-1926 (2 ♂, 1 ♀), M. C. Van Duzee (CAS); 14-II-1926 (1 ♀), 25-II-1926 (2 ♀), 28-II-1926 (2 ♀), E. P. Van Duzee (CAS); 1–6-III-1966 (7 ♂), 7-11-III-1966 (1 ♂, 2 ♀), R. H. Arnaud (CAS); 5-III-1926 (1 ♀), E. P. Van Duzee (CAS); 7-III-1926 (1 ♀), M. C. Van Duzee (CAS); 12-III-1920 (1 ♀), E. P. Van Duzee (CAS); 12-III-1926 (3 ♂, 5 ♀), M. C. Van Duzee (CAS); 16-III-1926 (1 ♂), W. Wild (CU); 17-III-1926 (1 ♀), 18-III-1924 (1 ♀), E. P. Van Duzee (CAS); 19–22-III-

1965 (1 ♀), P. H. Arnaud (CAS); 21-III-1926 (1 ♂, 1 ♀), M. C. Van Duzee (CAS); 30-III-1966 (2 ♂), P. H. Arnaud (CAS); 3–4-IV-1966 (2 ♂, 1 ♀), 5–7-IV-1966 (2 ♂), P. H. Arnaud (CAS); 7-IV-1926 (1 ♂), 9-IV-1926 (1 ♀), M. C. Van Duzee (CAS); 8–12-IV-1966 (4 ♂, 3 ♀), 19–23-IV-1966 (22 ♂, 5 ♀), 25-IV-1965 (4 ♂), 26-IV-1965 (4 ♂, 1 ♀), P. H. Arnaud (CAS); 28-IV-1958 (1 ♂), C. W. O'Brien (UCB); 29-IV-1958 (1 ♂), H. B. Leech (UCB); 1-V-1958 (1 ♀), H. B. Leech (UCB); 3-V-1924 (1 ♂), E. P. Van Duzee (CAS); 6-V-1926 (1 ♀), M. C. Van Duzee (CAS); 6–10-V-1965 (11 ♂, 13 ♀), P. H. Arnaud (CAS); 14-V-1924 (1 ♀), E. P. Van Duzee (CAS); 18–20-V-1965 (4 ♂, 3 ♀), 21–23-V-1965 (4 ♂, 6 ♀), P. H. Arnaud (CAS); 25-V-1924 (1 ♂, 2 ♀), E. P. Van Duzee (CAS); 4-VI-1957 (1 ♂), J. A. Powell (UCB); 4–5-VI-1965 (1 ♂), P. H. Arnaud (CAS); 12–13-V-1965 (6 ♂, 1 ♀), P. H. Arnaud (CAS); 27-VI-1925 (2 ♂), E. P. Van Duzee (CAS); 1–2-VII-1965 (1 ♂, 3 ♀), 3–6-VII-1965 (6 ♂, 1 ♀), 7–8-VII-1965 (1 ♂), P. H. Arnaud (CAS); 8-VII-1925 (1 ♂), E. P. Van Duzee (CAS); 9–12-VII-1965 (4 ♂, 1 ♀), 13–15-VII-1965 (5 ♂), P. H. Arnaud (CAS); 13-VII-1924 (1 ♂), E. P. Van Duzee (CAS); 19-VII-1925 (6 ♂, 2 ♀), 8-VIII-1925 (2 ♂, 2 ♀), H. H. Keifer (CAS); 6-X-1958 (1 ♂), H. B. Leech (UCB); 7-XI-1925 (1 ♂), E. P. Van Duzee (CAS); 5-XII-1925 (1 ♂, 4 ♀), E. P. Van Duzee (CAS). Phoenix Lake, 8-VI-1936 (2 ♀), r. f. manzanita berries (4-VII, 12-VII-1936), H. H. Keifer (USNM). Mt. Tamalpais, 15-VI-1960 (1 ♀), "on stem *Eriophyllum,*" J. A. Powell (UCB). Tomales Bay St. Park, 1-VIII-1969 (1 ♂, 2 ♀), ex manzanita berries (11-VIII, 22-VIII, 2-IX), J. A. Powell (UCB). *Mendocino Co.:* Mendocino, 19-V-1957 (1 ♀), J. R. Helfer (UCB). Novarro River, 29-V-1871 (1 ♂, 6 ♀—BMNM; 2 ♀—USNM), T. Walsingham [undesignated syntypes]. "Cal. Wlsm." (1 ♂) (USNM). Ukiah, 18-V-1966 (1 ♀), J. A. Powell (UCB). *Monterrey Co.:* Carmel, 1-I-1926 (1 ♀), 14-X-1933 (1 ♂), L. S. Slevin (CAS); IV (1 ♀—CU; 3 ♂, 2 ♀—USNM), VI (1 ♂—CU; 6 ♂, 7 ♀—USNM), A. H. Vachell. *San Francisco Co.:* San Francisco, 24-I-1920 (1 ♀), E. P. Van Duzee (CAS); 9-V-1909 (1 ♀), F. X. Williams (CAS). *San Mateo Co.:* Sierra Morena, 22-IV-1947 (1 ♀), r. f. *Vaccinium,* J. W. Tilden (ANSP). *Santa Cruz Co.:* Santa Cruz, 11-X-1932 (1 ♂), 24-X-1932 (1 ♂), (USNM). *Sonoma Co.:* Guerneville, I [no year] (1 ♀), (CAS).

Oregon.—*Coos Co.:* Bandon, 16-X-1946 (1 ♀), 18-X-1946 (1 ♂), (USNM). Tugman St. Park, nr. Lakeside, 10-VIII-1976 (1 ♂), J. A. Powell (UCB). *Douglas Co.:* Glide, 24-VIII-1954 (1 ♀), D. R. Davis (USNM). Tiller, 30-VI-1954, D. R. Davis (USNM). *Lane Co.:* Honeyman St. Park, 6 mi S Florence, 18-VIII-1962 (1 ♂), W. E. Ferguson (UCB).

Washington.—*Baker Co.:* Crosby, 11-VI-1934 (1 ♀), r. f. huckleberry, W. W. Baker (USNM). *King Co.:* Factoria, 9-IV-1949 (3 ♂, 3 ♀), E. C. Johnston (CNC). Seattle, 1-III-1896 (1 ♂), (USNM). *Mason Co.:* Shelton, 16-IV-1949 (2 ♀), E. C. Johnston (CNC). *Pacific Co.:* Sea View, 6-IV-1919 (1 ♀), 12-X-1918 (1 ♀), H. K. Plank (USNM). *Pierce Co.:* Jig Harbor, XI-1935 (5 ♂, 1 ♀), ex *Vaccinium ovatum* fruits, Baker & Wilcox (USNM). Rosedale, 20-IX-1963, ex *Vaccinium ovatum* fruits (em. II-1964), E. P. Breakey & E. G. Tinius (USNM). *Thurston Co.:* Olympia, 3-IV-1893 (2 ♂), T. Kincaid (CU); 1-XI-1944 (1 ♂), 20-XII-1944 (1 ♀), ex huckleberry (USNM). Tenino, 23-IV-1949 (1 ♂), E. C. Johnston (CNC). *Whatcom Co.:* Morovitz R. S., 10-VIII-1931 (1 ♂), J. F. G. Clarke (USNM).

Remarks.—The great distance between the Pacific Coast populations and the Mexican populations, has prompted the use of subspecies for *L. trigonana.* There appear to be no differences between the two races that are not within the range

of variation from the different localities. Northern specimens of the nominate subspecies (British Columbia) tend to be larger and darker than specimens from central or southern California. The Mexican specimens, however, tend to be as large and dark as the specimens from British Columbia. There are no records of typical *L. trigonana* from localities very far inland from the Pacific Coast. Records are lacking south of Monterrey and Carmel, California, except for a unique specimen from Santa Cruz Id., Los Angeles Co. The ericaceous hosts, such as *Arbutus* and *Arctostaphylos,* range south into northern Baja California, but thus far no moths have been found from these southern areas. The extreme northern record, in Alaska, indicates that *L. trigonana* should be found all along the Pacific Coast: there is a possibility, however, that the Alaska locality ("Orca") refers to the Oras Islands of Puget Sound, Washington, since the 1899 Harriman Alaska Expedition, which collected the single specimen, may have started collecting in Puget Sound.

Lotisma trigonana and *L. vulcanicola* show no major differences in the female genitalia except in the bursa, but the male genitalia have significant differences in the uncus, the shape of the valvae, and the aedeagus. Likewise, the adult maculation shows some differences, although it is obvious that the species are very closely related.

Lotisma trigonana durangoensis, New Subspecies

A Mexican and Central American race of *L. trigonana,* not of significant difference morphologically but generally darker or more gray.

Forewing length.—7.5–7.8 mm (♂); 8.5–10.0 mm (♀).

Male (see Fig. 8).—As in *L. trigonana* but with forewing subterminal lines usually more distinct; overall wing pattern darker, a higher frequency of adults having the forewing basal dark spot at ⅓ from wing base as a dual spot (this is less frequent in the nominate subspecies). Male genital characters as in the typical subspecies.

Female (Fig. 8).—Same as male in wing pattern. *Female genitalia:* same as in the typical subspecies but apophyses tending to be slightly longer.

Immature stages.—Unknown.

Host.—Unknown (presumably Ericaceae as in the nominate subspecies).

Distribution.—Mexico (Durango and nearby border area of Sinaloa); Costa Rica.

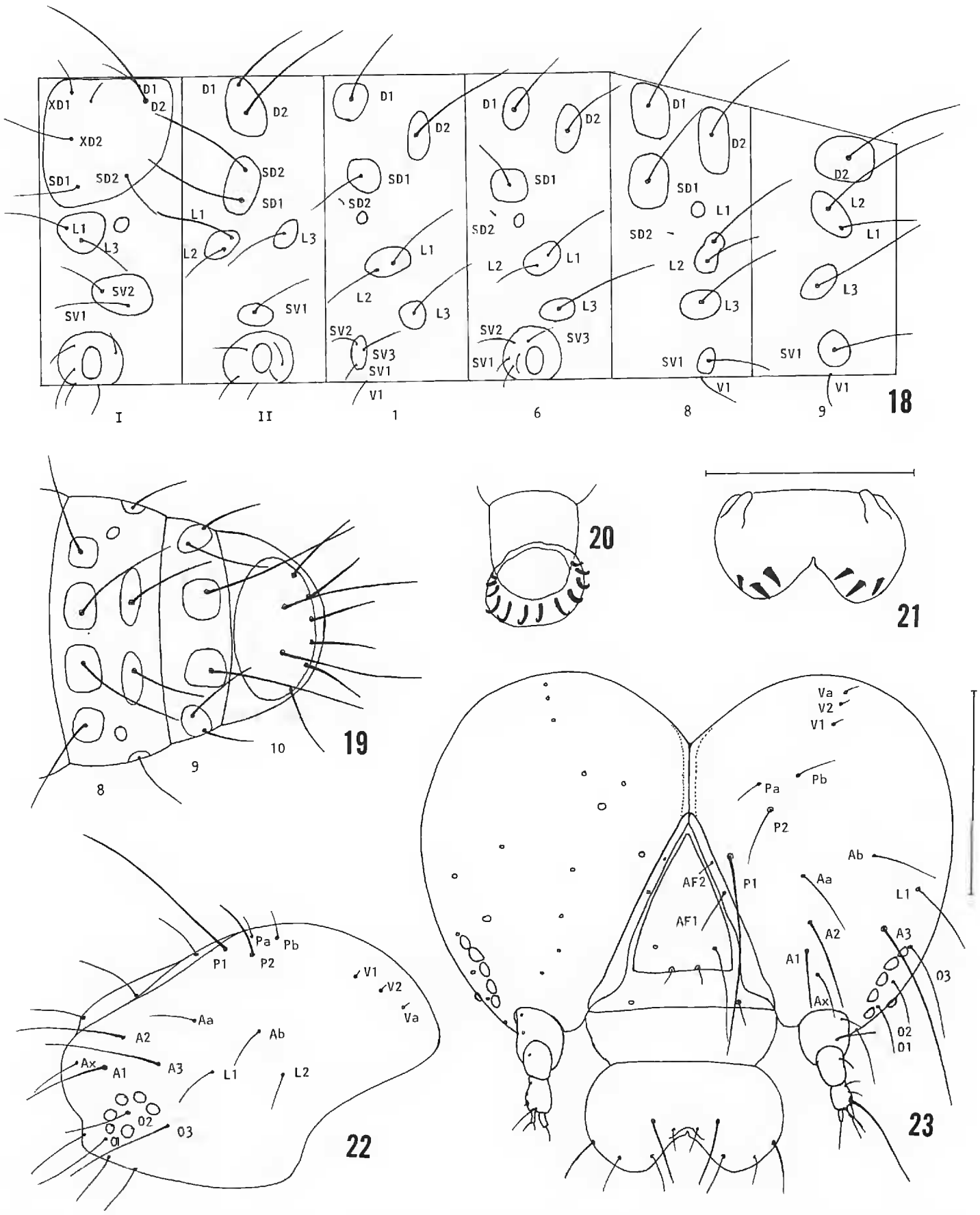
Flight period.—July–August; May (Costa Rica).

Types.—Holotype ♀ (UCB): Mexico: 10 mi W El Salto, Durango, 21-VII-1964, 8800 ft, Chemsak & Powell (Slide JBH 294).

Paratypes (12 ♂, 12 ♀).—MEXICO. *Durango:* 30 mi W Durango, 8400 ft [2554 m], 3–7-VIII-1972 (2 ♀), Powell, Veirs & MacNeill (UCB). El Salto (9 mi W), 8800 ft [2675 m], 2-VII-1964 (2 ♀), Chemsak & Powell (UCB). Las Rusias, 12 mi E La Ciudad, 9200 ft [2797 m], 14–18-VIII-1972 (2 ♂), Powell, Veirs & MacNeill (UCB). La Ciudad (24 mi W) 7500 ft [2280 m], 19-VII-1964 (10 ♂, 3 ♀), J. A. Powell (UCB). *Sinaloa:* El Palmito (4 mi W), 20-VI-1964 (1 ♂, 1 ♀), J. A. Powell (UCB); (8 mi W), 6400 ft [1945 m], 8–12-VIII-1972 (4 ♀), Powell, Veirs & MacNeill (UCB).

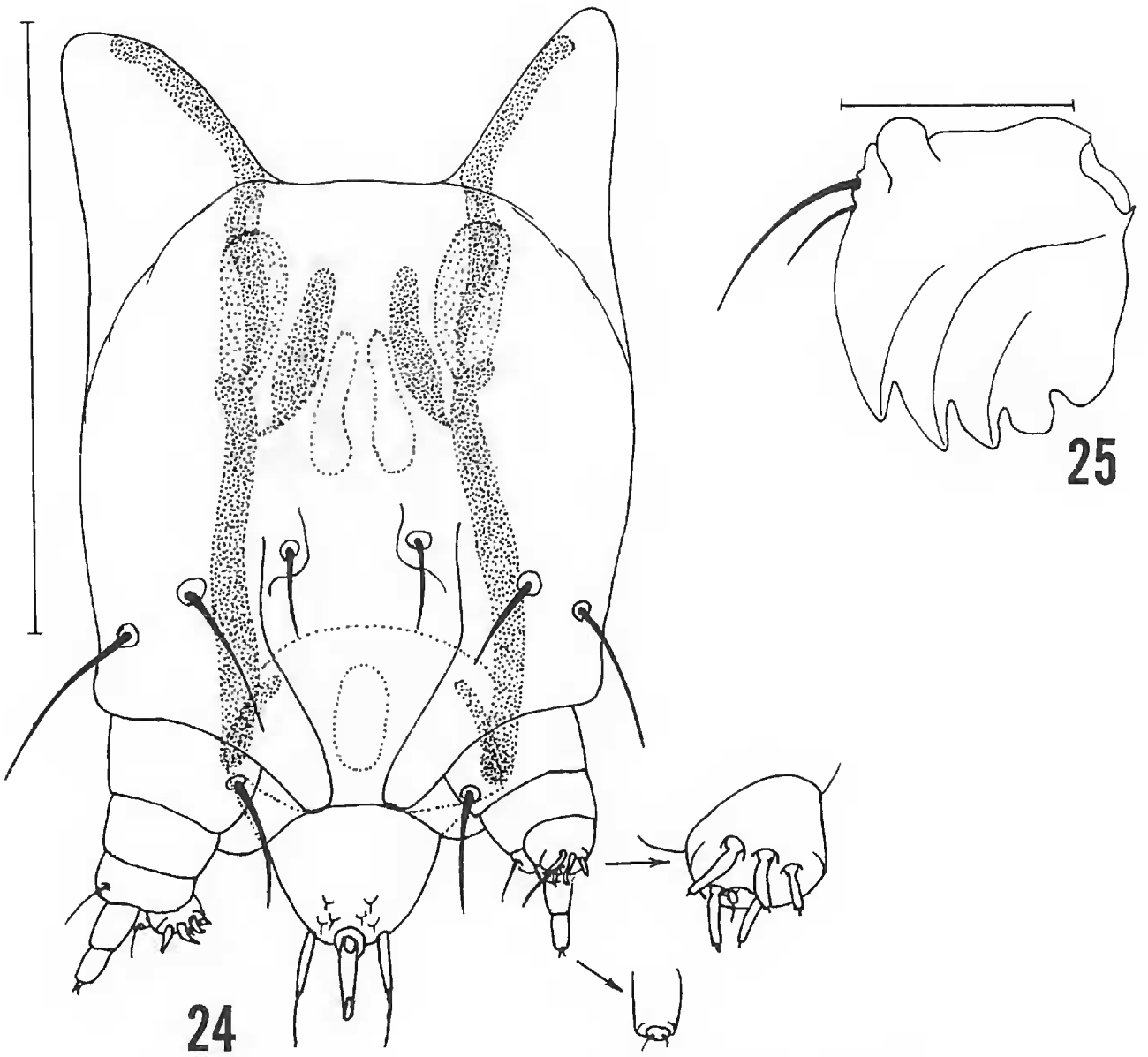
Additional specimens.—COSTA RICA. *Cartago:* Cerro de la Muerte, Pension La Georgina, 3000 m, 23/25-V-1985 (2 ♀), J. A. Powell & P. A. Opler (UCB).

Remarks.—As noted for the typical populations of *L. trigonana,* there are no significant differences between the Mexican and Costa Rican segregates and the



Figures 18–23. Larval characters of *Lotisma trigonana* (Walsingham). 18. Larval chaetotaxy. 19. Caudal segments (dorsal view). 20. Proleg and crochets. 21. Labrum (ventral view) (scale line = 0.5 mm). 22. Head (lateral view). 23. Head (front view, with labrum attached) (scale line = 0.5 mm).

Pacific Coast populations. The two subspecies are extremely disjunct, especially so when one notes that typical *L. trigonana* is found only along the Pacific Coast, with no interior records south or in Arizona or the Great Basin. *L. trigonana durangoensis* may well range over much of the Sierra Madre Occidental south to Costa Rica where more recent collections have located another segregate population.



Figures 24, 25. Details of *Lotisma trigonana* (Walsingham) larva. 24. Submentum (ventral view) (scale line = 0.5 mm), with details (at arrows) enlarged. 25. Mandible (ventral side) (scale line = 0.2 mm).

Lotisma vulcanicola Meyrick

Lotisma vulcanicola Meyrick, 1932:285.

A Central American species superficially very similar to *L. trigonana.* Diagnostic characters are in the male genitalia, where the valvae have a distinct narrowed area near the apex and the uncus is short.

Forewing length.—7.8–8.3 mm (♂); 8.0–9.1 mm (♀).

Male (Fig. 9).—*Head:* tan, with white on frons; antenna tan, with long central cilia; labial palpus dark brown with white on apical segment and on mesal side. *Thorax:* tan, with some white posteriorly; patagia dark brown anteriorly and white on posterium; venter white; legs tan and white. *Forewing* (Fig. 9): lustrous white, with dark brown patch at base along costal margin; a mid-wing diagonal dark brown bar from costa at CuP fold, directed toward tornus; another dark brown patch on costal margin at ⅔ from base; a small dark brown spot at end of discal call; apical quarter with various dark brown marks forming an indistinct subterminal line; apex with dark brown bar near end and tan along costal margin; fringe white, brown with white on anal field. *Hindwing:* lustrous white, somewhat translucent centrally; fringe white, venter white. *Abdomen:* white and tan; venter white.

Figure 26. Female genitalia of *Lotisma vulcanicola* Meyrick plesiotype, Costa Rica (JBH 1855, UCB).

Male genitalia (Fig. 12): as described for the genus but with the uncus short (ca. 1¼× anellus height); valva with narrow distal end having distinct "neck" following the basal width; anellus basally straight and without an invagination; aedeagus without distal spines (Fig. 13).

Female.—As in the male. *Female genitalia* (Fig. 26): as for the genus but with papilla anales slightly longer than anterior apophyses; ductus bursae little scler-

otized and short, merging into large corpus bursae having a narrow extension twice bursa length.

Immature stages.—Unknown.

Host.—Unknown (conceivably Ericaceae hosts as in *L. trigonana*).

Distribution.—Costa Rica (2200–3000 m).

Flight period.—May.

Types.—Holotype ♂ (NHMV): Costa Rica: Irazu, 21–28-V-1930, Reimoser, 2200–2500 m. Plesiotype ♀ (UCB): Costa Rica: Cartago Prov., Cerro de la Muerte, Pension La Georgina, 3000 m, 23/25-V-1985, J. A. Powell & P. A. Opler (UCB).

Additional specimens.—COSTA RICA. Cartago: Cerro de la Muerte, Pension La Georgina, 3000 m, 23/25-V-1985 (5 ♂, 2 ♀), J. A. Powell & P. A. Opler (UCB). 7 km SE El Canon, 2500 m, 28-V-1985 (1 ♂), J. A. Powell & J. T. Doyen (UCB).

Remarks.—*Lotisma vulcanicola* has been found again only recently, since the unique male was originally collected in 1930. It is conceivable that the distribution of this species may be much wider in Central America but this will require more extensive collections of microlepidoptera in the region to determine. Various Ericaceae should be searched as the possible host of this species at appropriate elevations. Fresh adult specimens have the dark forewing markings more pronounced than shown for the somewhat worn holotype (Fig. 9) but the species retains the more extensive silvery white areas of the forewings that distinguish it markedly from *L. trigonana.* At Cerro de la Muerte recent collections have also for the first time found both *L. vulcanicola* and *L trigonana* flying at the same time, with *L. trigonana* being noticeably darker and gray in coloration compared to *L. vulcanicola.*

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